

Diffractively Produced Charm Final States in p - p Interactions at 800 GeV/c

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Abstract

We report the observation of charm final states produced by the diffractive dissociation reaction $pp \rightarrow pX$ at a c.m. energy of $\sqrt{s} = 40$ GeV. Signals are observed for the decay modes $D^{*+} \rightarrow (K^-\pi^+)\pi^+$ and $D^{*-} \rightarrow (K^+\pi^-)\pi^-$. Our results are based on analysis of data representing over 50% of the 5.5 billion events acquired by experiment E690 in the Fermilab 1991 fixed target run.

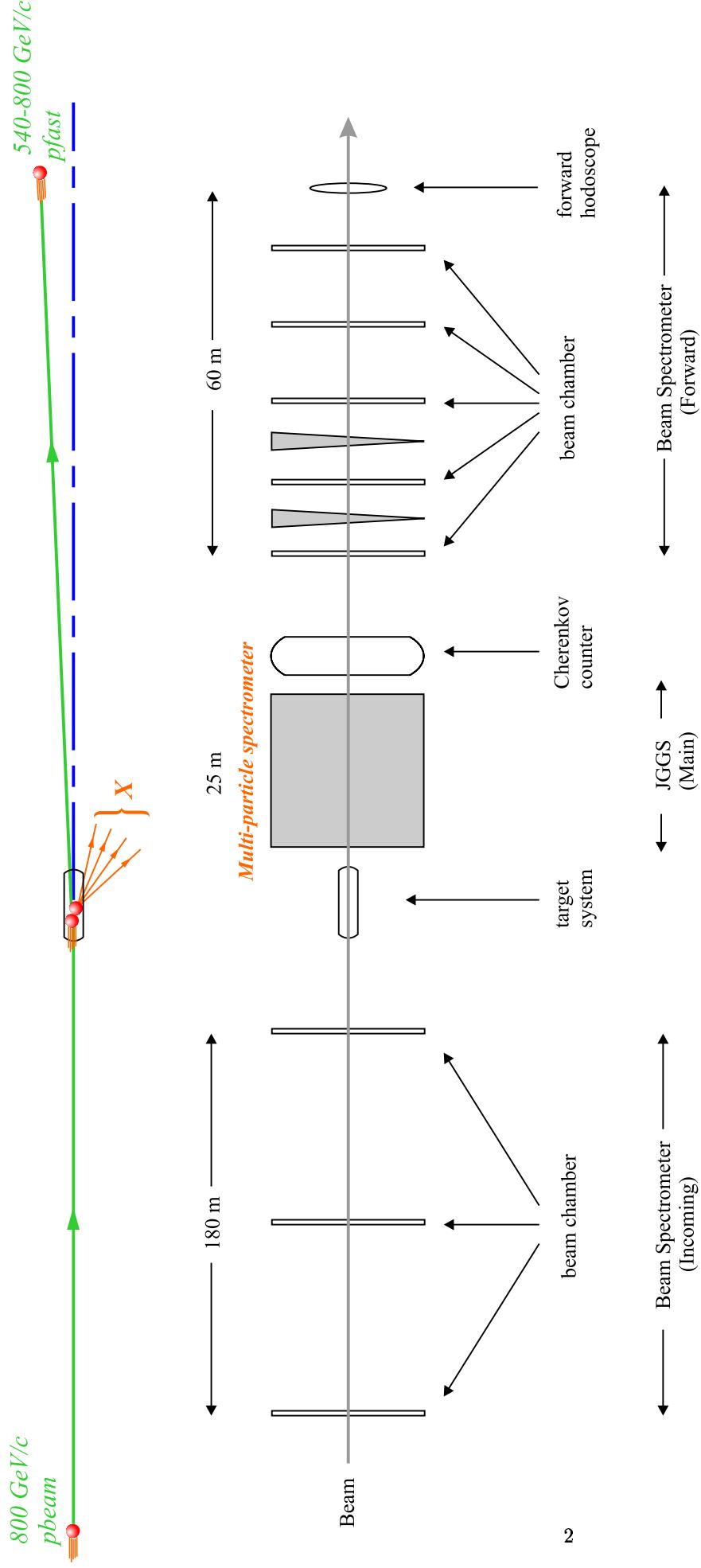
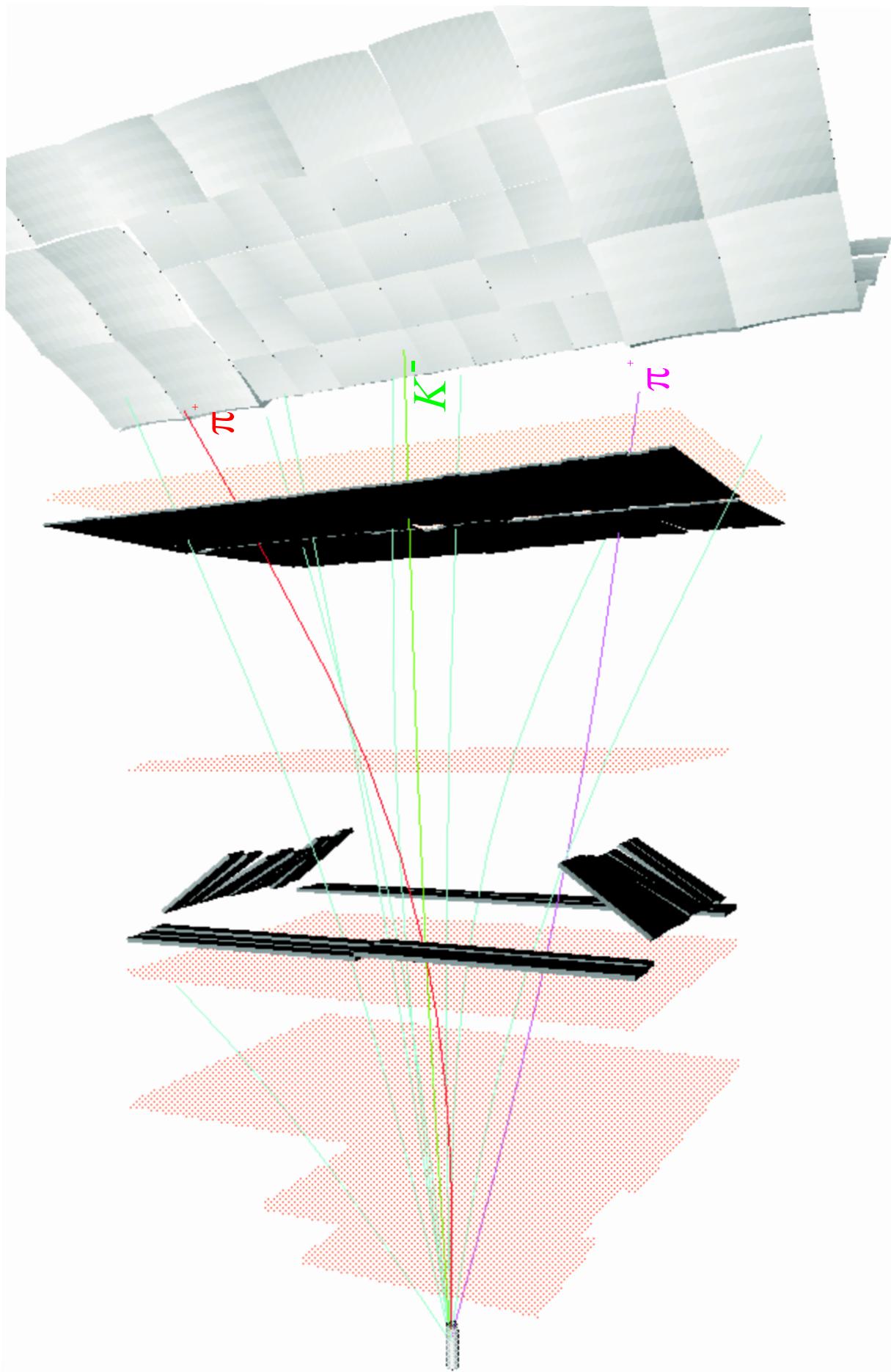


Figure 1 E690 spectrometer (not to scale).

data taking:

- 1) an incoming beam proton
 - 2) an outgoing beam proton (p_{fast}) in the forward spectrometer
 - 3) at least one extra charged track in the main spectrometer
- number of events meeting these req.: $\sim 5.5 \times 10^9$
 number of events used for this analysis: $\sim 51\%$ of entire sample
 $\rightarrow 2,792,176,693$ events



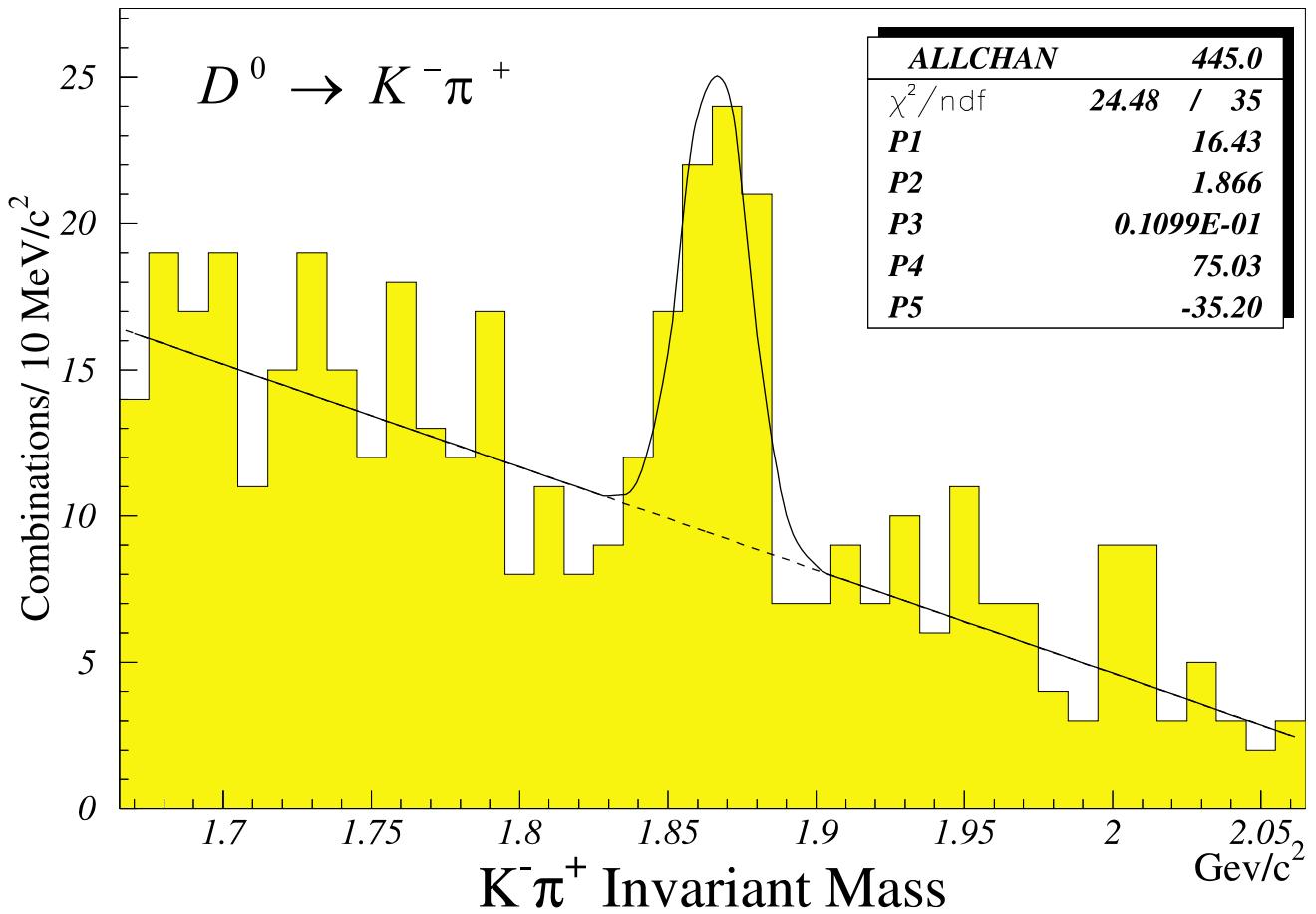
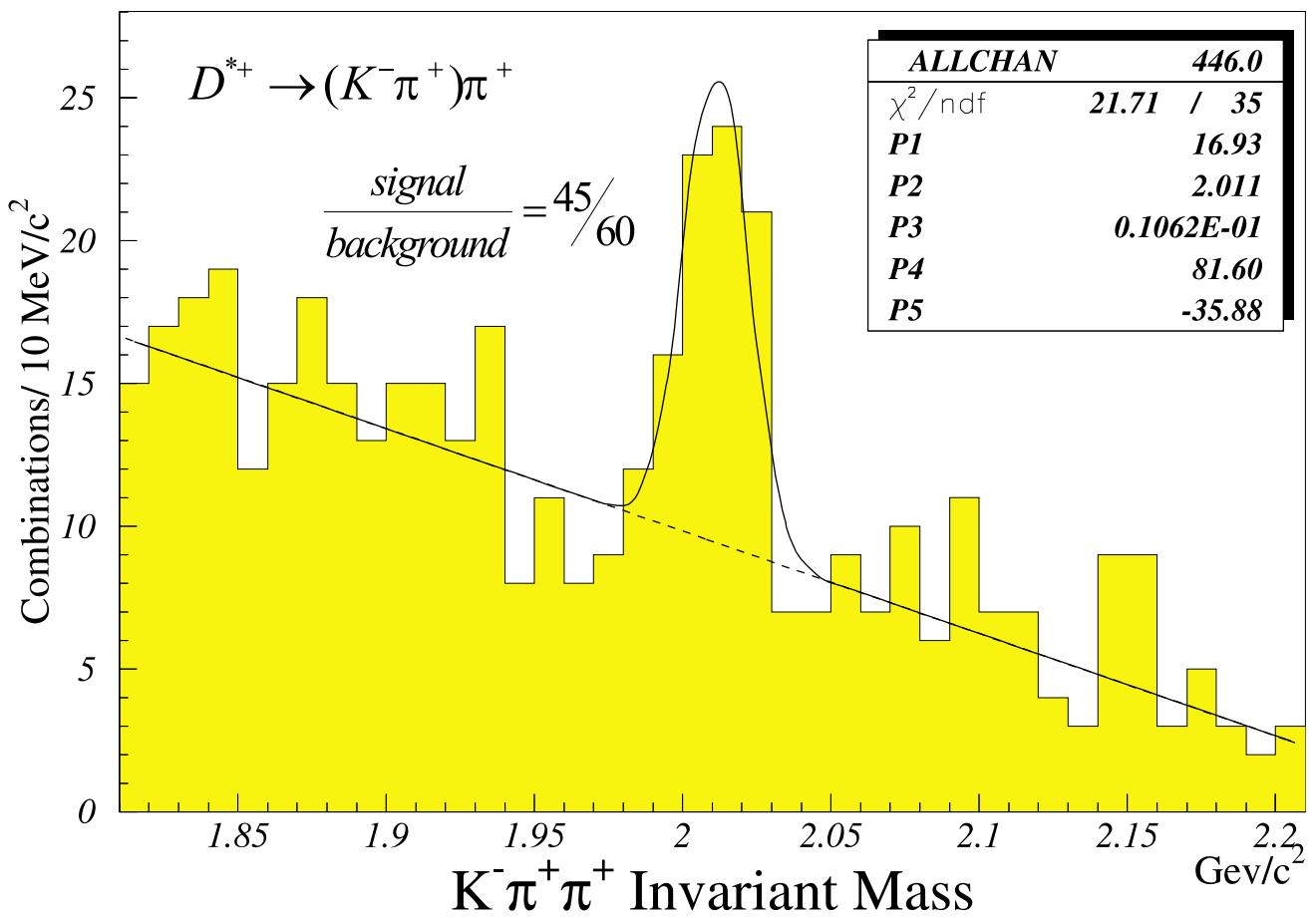
Initial number of events: 2,792,176,693

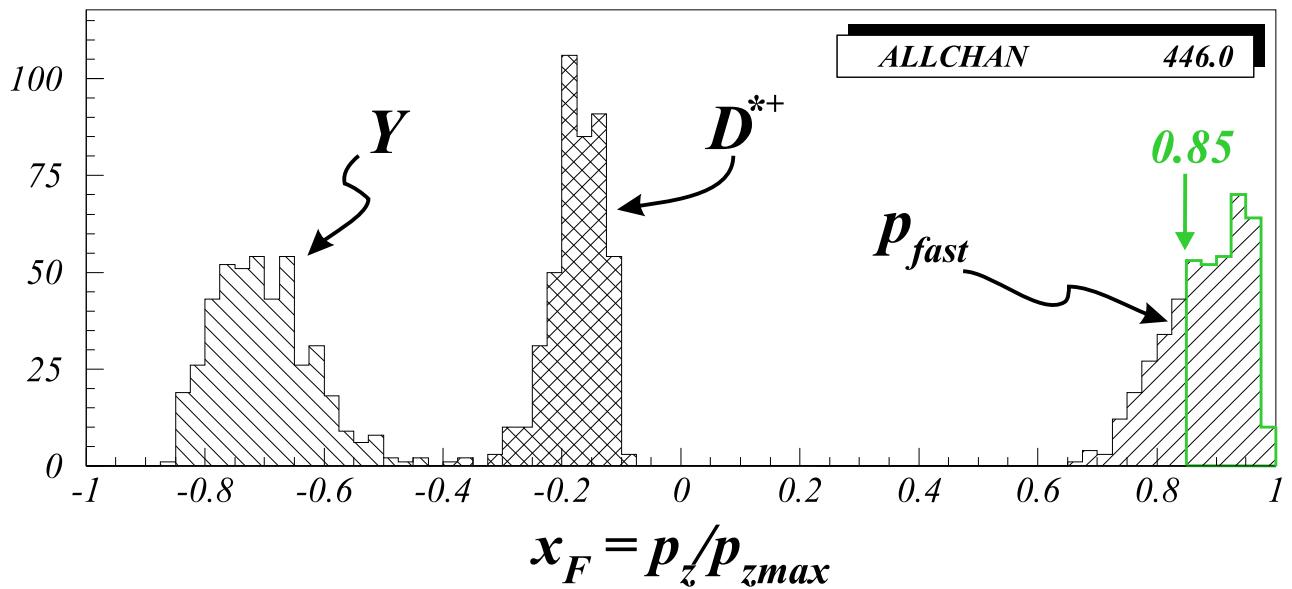
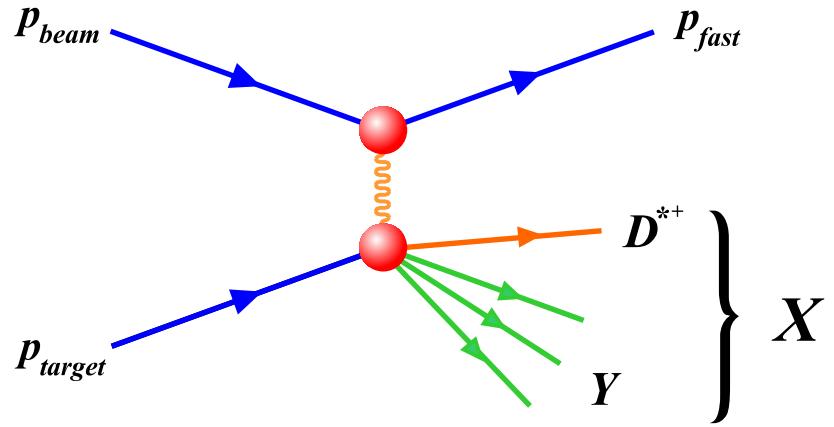
Table 1 Number of Events Surviving Cuts

<i>Cuts Applied</i>	$D^{*+} \rightarrow (K\pi^+)\pi^+$	$D^* \rightarrow (K^+\pi^-)\pi^-$
<i>Kππ inv. mass combination:</i> <i>Cerenkov Identified K</i> $1.810 < M(D^*) < 2.210$ $0 < Q < .01166$	225,507	271,255
<i>Cerenkov Identified π</i>	27,211	51,599
$ Q - .00583 < .0005 \text{ GeV}/c^2$	2,656	4,916
<i>Time of Flight identified slow π</i>	446	1,276

where:

$$Q = M(K\pi\pi) - M(K\pi) - M(\pi)$$



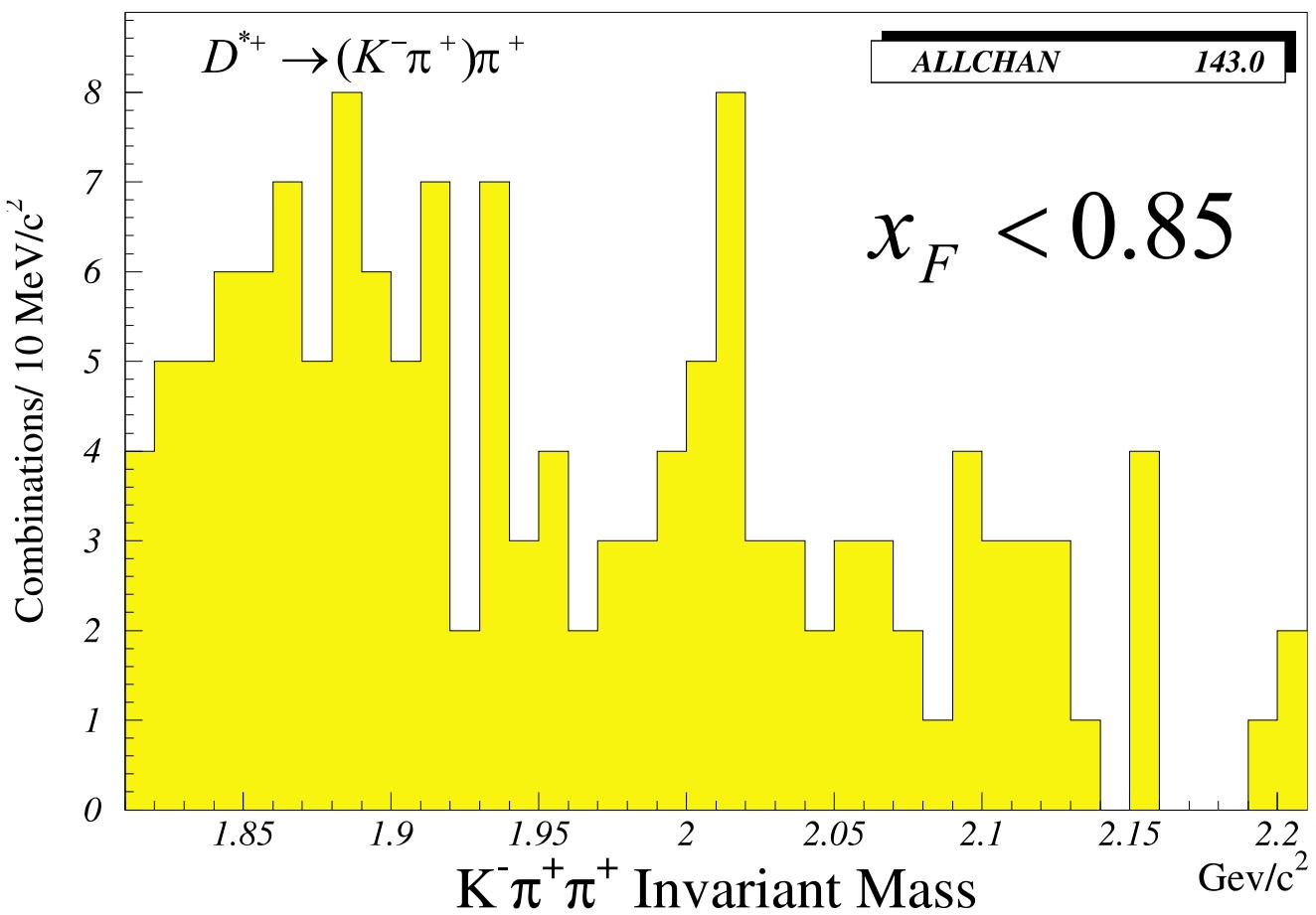
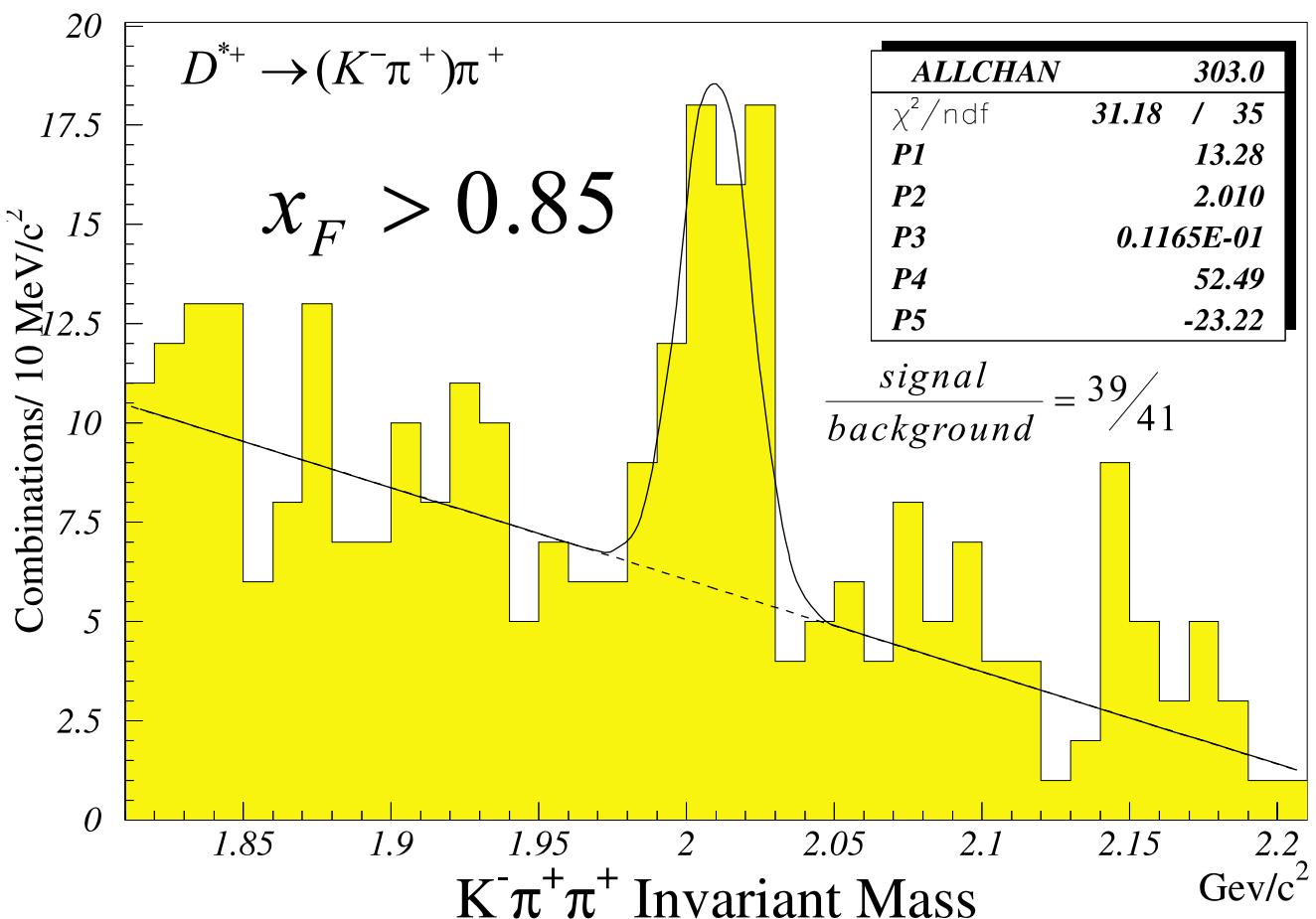


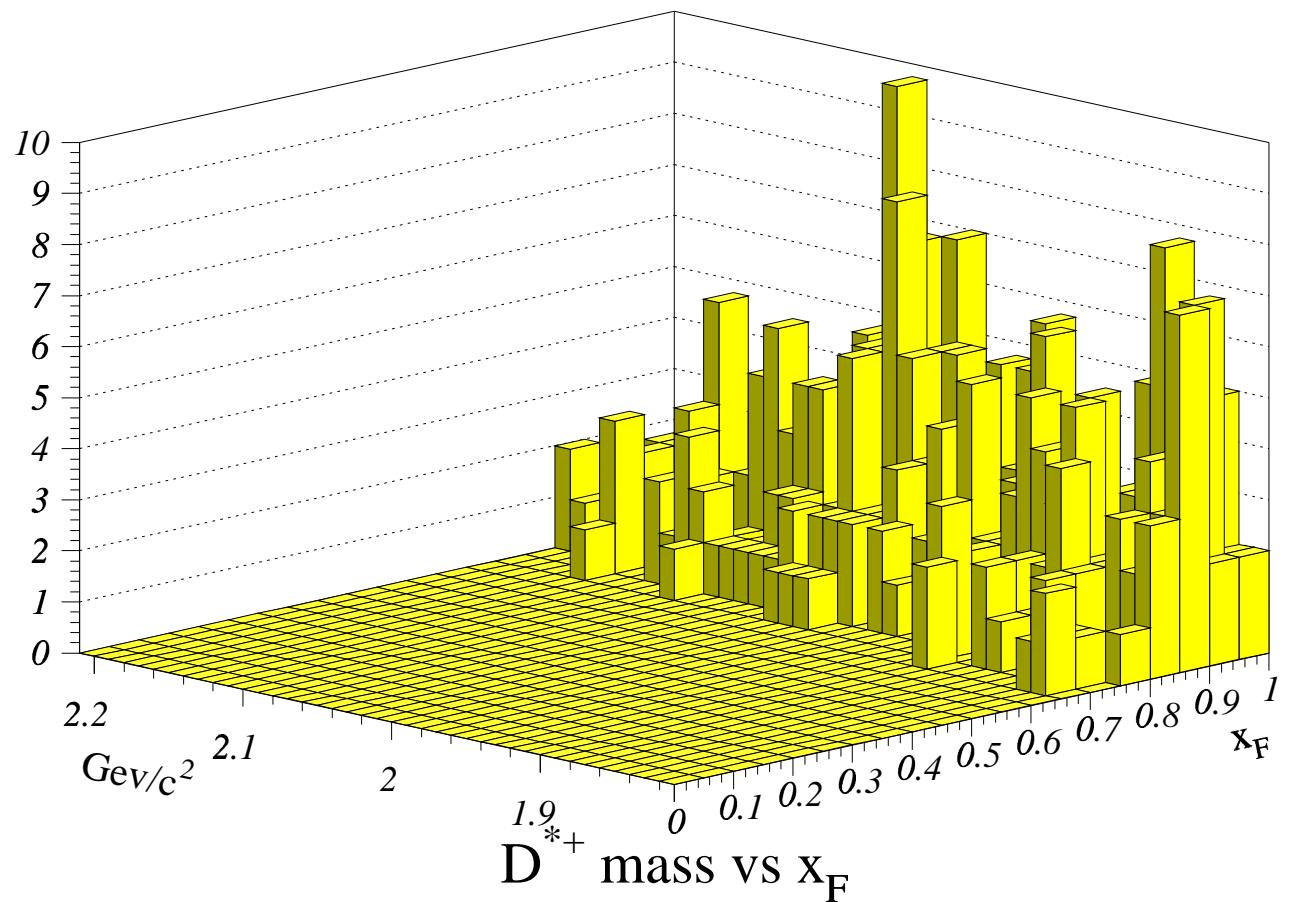
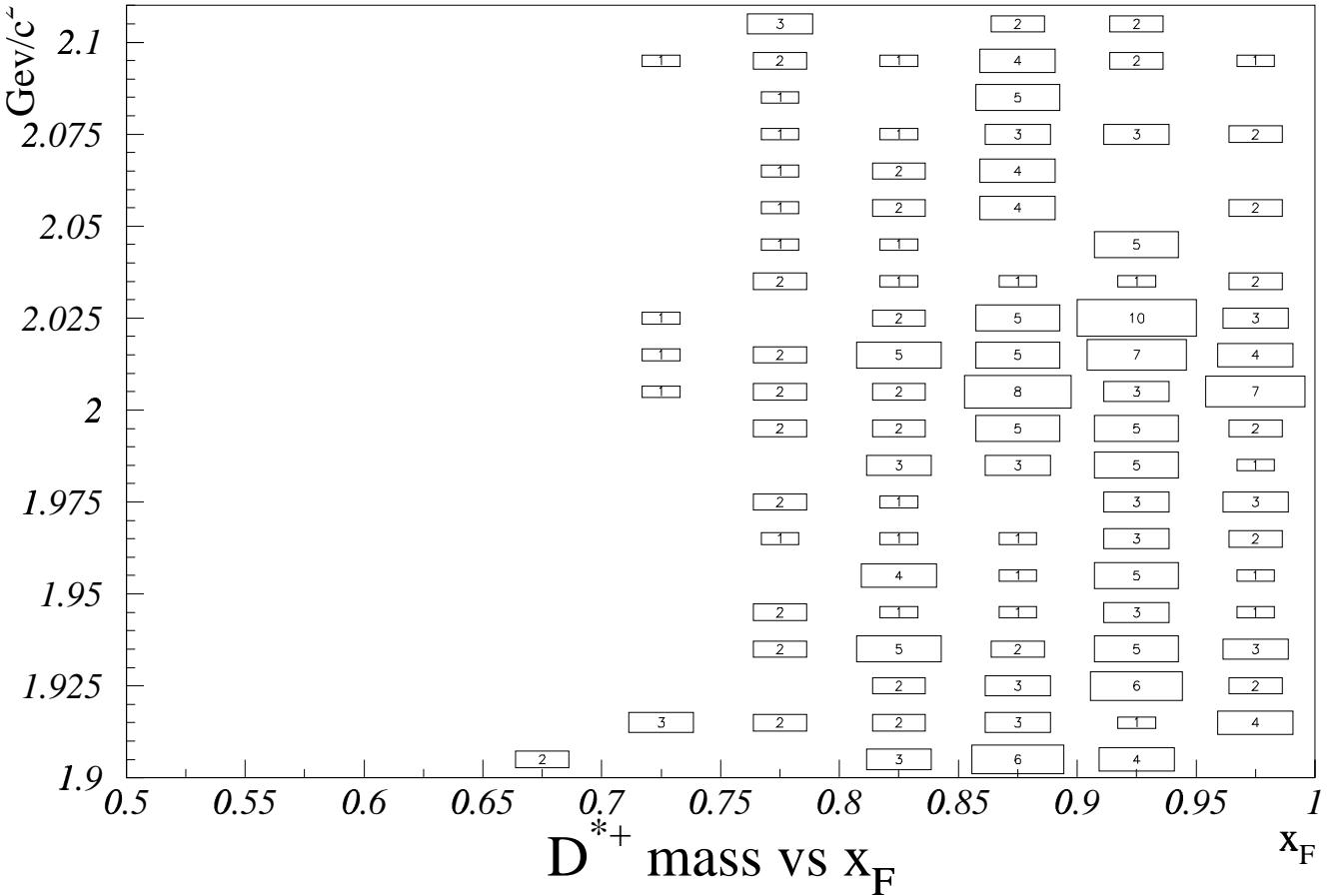
Coherence condition:

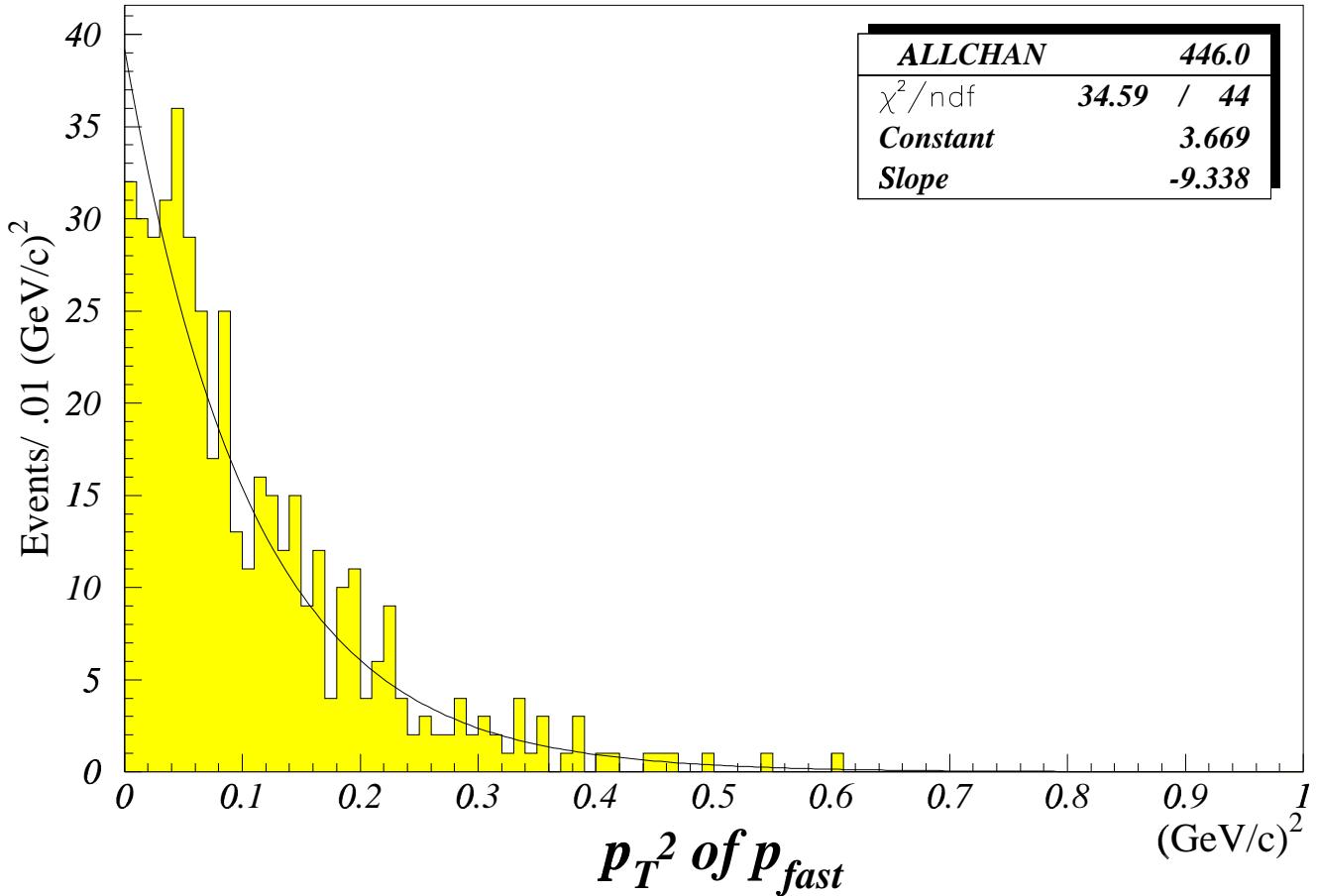
$$(1 - x_F) < 0.15$$

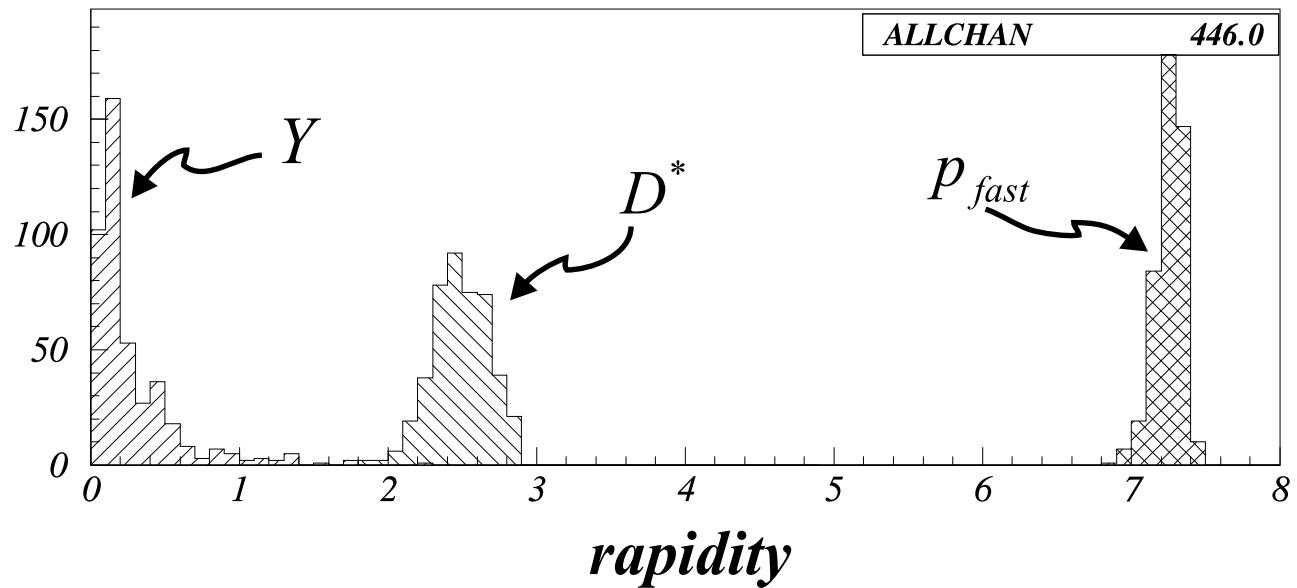
from:

K.Goulianos, Phys. Rep. 101, 170 (1983).



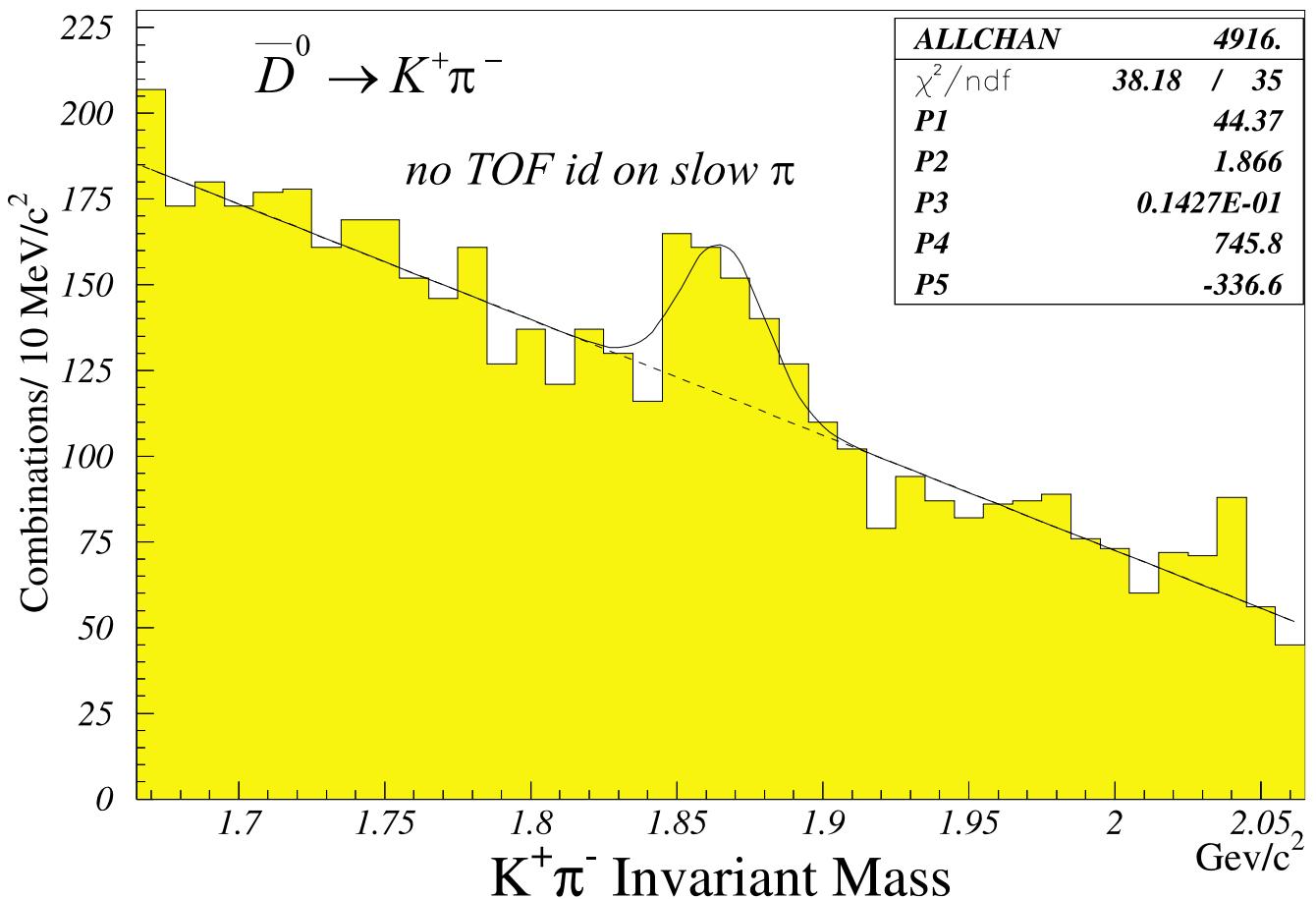
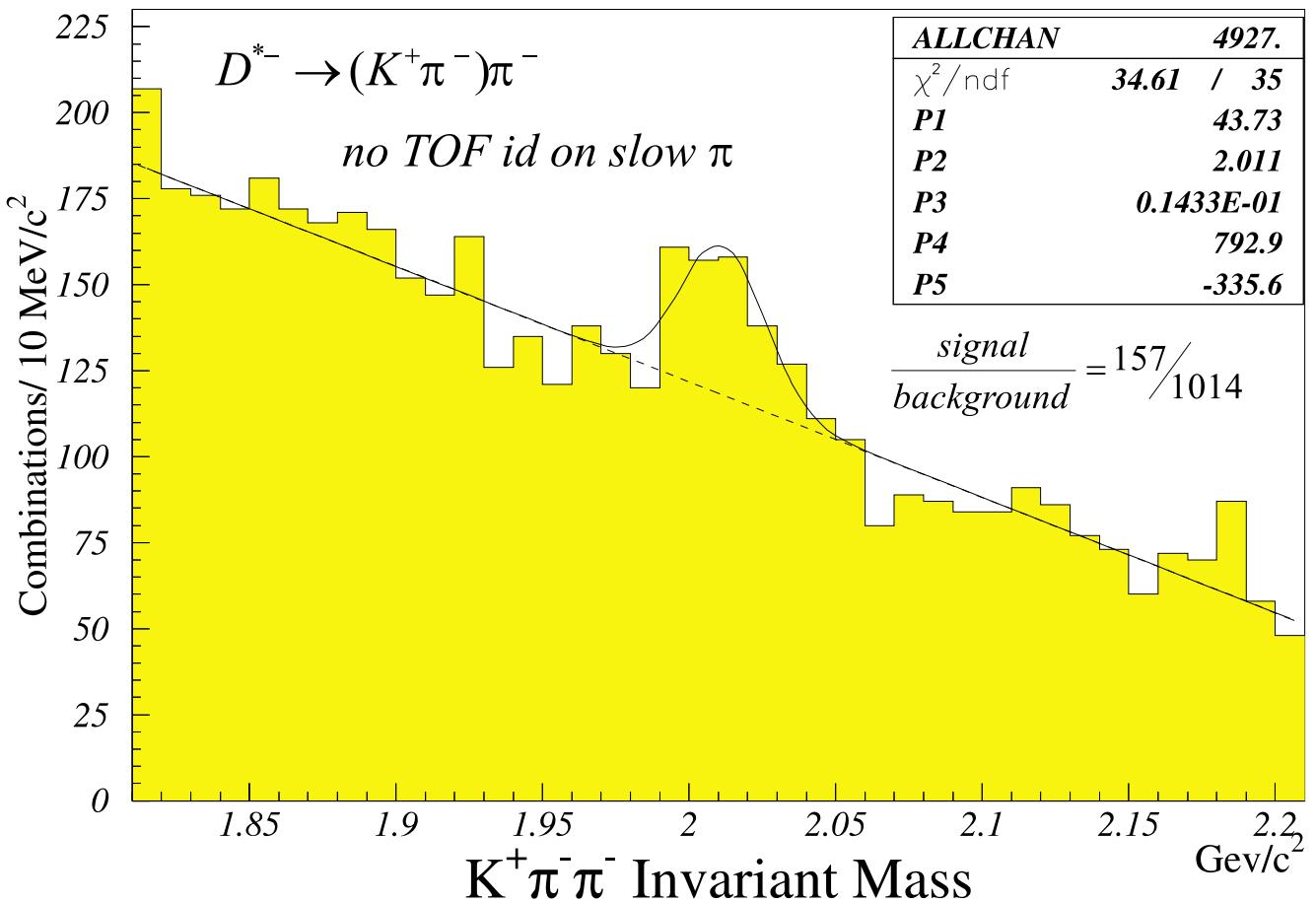


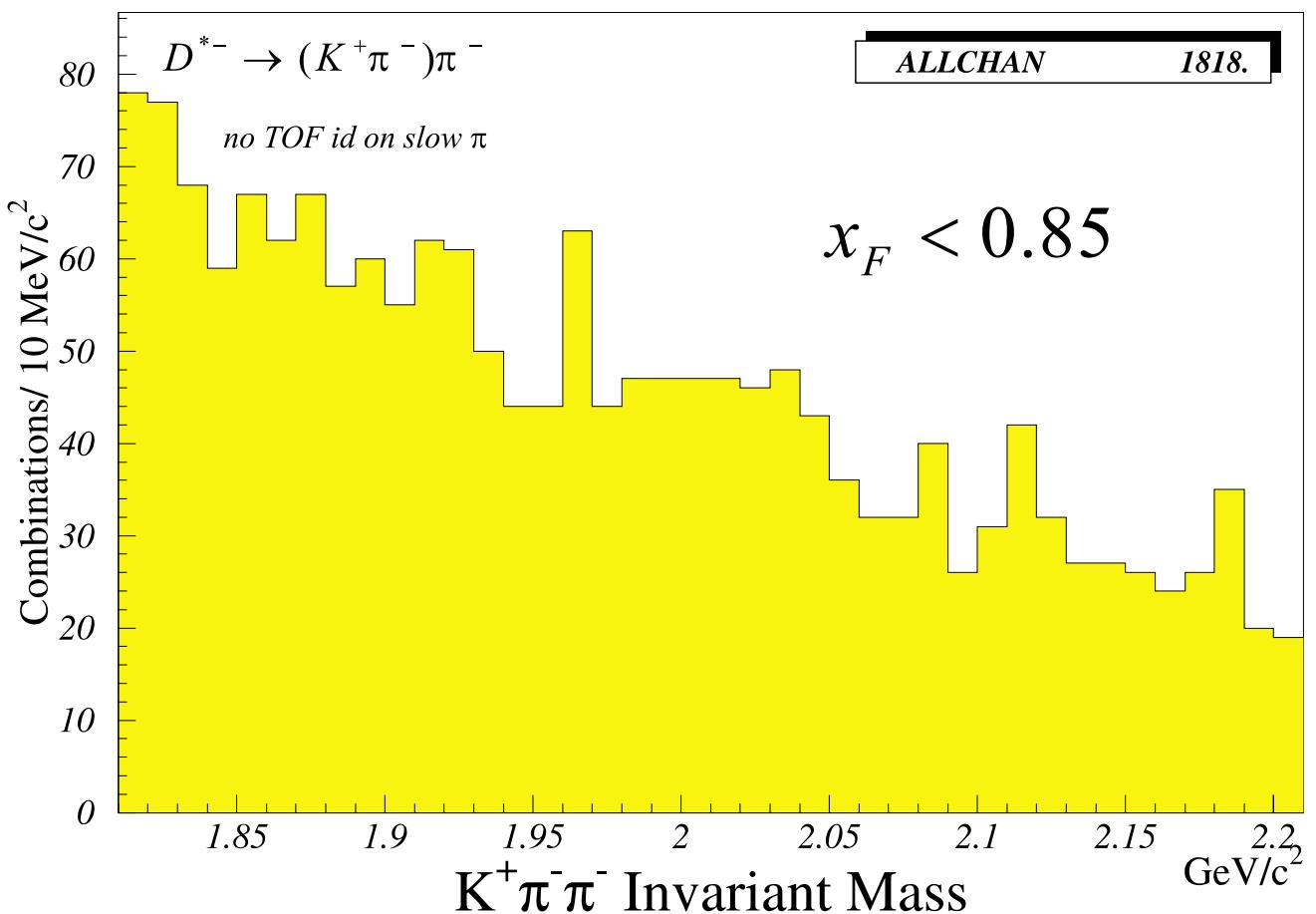
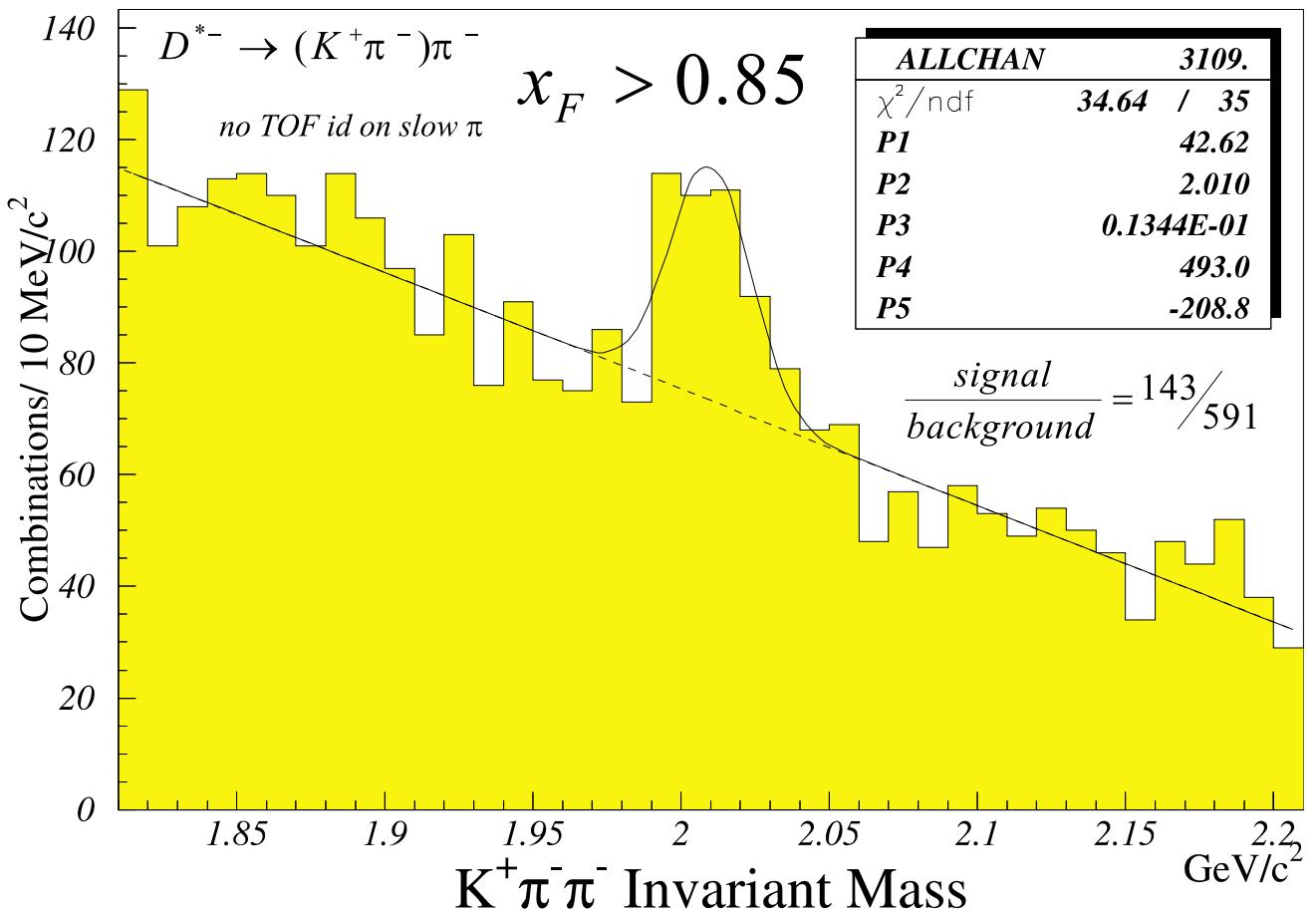




where:

$$\text{rapidity} = \frac{1}{2} \ln \left(\frac{E + P_L}{E - P_L} \right)$$





Conclusions

- 2.8×10^9 events ~50% entire e690 data sample:

		$x_F > 0.85$
$D^{*+} \rightarrow D^0 \pi^+$	<i>45 events</i>	<i>39 events</i>
$D^{*-} \rightarrow \bar{D}^0 \pi^-$	<i>157 events</i> [*]	<i>143 events</i>

**without TOF id*

-charm is produced diffractively in hadronic interactions

-FNAL E653 results:

$$\begin{aligned}\sigma_{diff}(cc) &< 26 \mu b \\ \sigma_{diff} &\approx A^{2/3} \\ \Rightarrow \sigma_{diff}(cc) &< 2.8 \mu b \text{ for } p-p\end{aligned}$$

Very Preliminary Cross Section Estimates

$$\textbf{Model A: } \frac{dN}{dM_X} \approx \text{constant}$$

$$\textbf{Model B: } \frac{dN}{dM_X} \approx \frac{1}{M_X^2}$$

$$\textbf{Model C: } \frac{dN}{dM_X} \approx p_1 + p_2 M_X + p_3 M_X^2 + p_4 M_X^3$$

charm threshold < $M_X < 22 \text{ GeV}/c^2$

$$\frac{dN}{dp_T^2} \approx \exp(-bp_T^2)$$

Model	$\sigma_{SD}(c\bar{c})$
A	0.81 μb
B	0.66 μb
C	1.47 μb